UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ANIMAL INDUSTRY

STEPS IN DETERMINING VARIABILITY OF THE COCKEREL AND PULLET WEIGHTS AS TO BE REPORTED IN THE N.P.I.P. MEAT PRODUCTION PERFORMANCE TEST

(Coefficient of variation)*

A. Recommended procedure when a calculator is available:

1. Arrange the individual live weights of the cockerels of the entry in table form. (See Note and Example A)

2. Total the weights (37.0).

3. Obtain the average weight by dividing the total obtained in Step 2 by the number of cockerel weights included in the entry.

$(\frac{37.0}{10} = 3.7)$

4. Square each weight (multiply each weight by itself) and add these squares. (3.8 x 3.8 = 14.44; 3.6 x 3.6 = 12.96; - - - - 4.5 x 4.5 = 20.25; = 139.74)

5. Multiply the total obtained in Step 2 by the average obtained in Step 3. (37.0 x 3.7 = 136.90)

6. Subtract the answer obtained in Step 5 from the total obtained in Step 4. (139.74 - 136.90 = 3.84)

7. Divide the answer obtained in Step 6 by the number of weights included in the entry. $(\frac{2.84}{10} = .284)$

8. Extract the square root of the answer obtained in Step 7. $(\sqrt{.284} = .533)$ This is the standard deviation.

9. Multiply the standard deviation obtained in Step 8 by 100. (.533 x 100 = 53.3)

10. Divide the answer obtained in Step 9 by the average weight obtained in Step 3. $(\frac{53.3}{3.7} = 14.405)$ This is the coefficient of variation for the cockerels.

11. Follow the above ten steps, using the pullet weights instead of the cockerel weights.

EXAMPLE A

	WTS. (LBS)	WTS. (SQUARED)
1.	3.8	14.44
2.	3.6	12.96
3.	4.2	17.64
4.	2.5	6.25
5.	3.7	13.69
6.	3.1	9.61
7.	3.7	13.69
8.	3.9	15.21
9.	4.0	16.00
10.	4.5	20.25
TOTAL	37.0	139.74
Average	3.7	
	(Total x Av.) = (37.0 x 3.7) =	136.90
	Difference	2.84
	Difference ÷ 10	.284

Square root of .284 = $\sqrt{.284}$ = .533 = standard deviation

$$\frac{\text{Standard deviation x 100}}{\text{Average wt.}} = \frac{53.3}{3.7} = 14.405 = \text{coefficient of variation}$$

B. Recommended procedure when no calculator is available:

1. Arrange the individual live weights of the cockerels of the entry in table form. (See Note and Example B)

2. Total the weights (37.0).

3. Obtain the average weight by dividing the total obtained in Step 2 by the number of cockerel weights included in the entry.

   ($\frac{37.0}{10} = 3.7$)

4. List in column two the difference between each weight and the average calculated in Step 3. (3.8 - 3.7 = .1; 3.6 - 3.7 = -.1; 4.2 - 3.7 = .5; - - - - 4.5 - 3.7 = .8).

If the bird's weight is less than the average precede such difference by a "-" sign. If the weight is more than the average precede the difference by a "+" sign. A good check on the accuracy of the computation of this column is to add all the "+" deviations, then add all the "-" deviations in the column two. The sum of the "+" deviations and the "-" deviations is "0".

5. Square each item in column two and insert answer in column three. That is, multiply each item in column two by itself to obtain the items in column three (.1 x .1 = .01; - - - - - - .8 x .8 = .64). Here we omit the "+" sign since all numbers, whether "-" or "+" become "+" when they are squared.

6. Total column three (2.84).

7. Divide the total obtained in Step 6 by the number of weights included in the entry. $\left(\frac{2.84}{10} = .284\right)$

8. Extract the square root of the answer obtained in Step 7. $\left(\sqrt{.284} = 0.533\right)$. This is the standard deviation.

9. Multiply the answer obtained in Step 8 by 100. (.533 x 100 = 53.3)

10. Take the figure obtained in Step 2. $\left(\frac{53.3}{3.7} = 14.405\right)$. This is the coefficient of variation for the cockerels.

11. Follow the above ten steps, using the pullet weights instead of the cockerel weights.

EXAMPLE B

	Column 1 WEIGHTS (Lbs.)	Column 2 DEVIATION (Actual wt. - Average wt.)	Column 3 DEVIATION SQUARED
1.	3.8	.1	.01
2.	3.6	-.1	.01
3.	4.2	.5	.25
4.	2.5	-1.2	1.44
5.	3.7	0	0
6.	3.1	-.6	.36
7.	3.7	0	0
8.	3.9	.2	.04
9.	4.0	.3	.09
10.	4.5	.8	.64
TOTAL	37.0	0	2.84
Average	3.7		.284

Standard deviation = square root of the average "deviation squared" = $\sqrt{.284} = 0.533$

Coefficient of variation = $\frac{\text{standard deviation}}{\text{average weight}} 100 = \frac{.533}{3.7} \times 100 = 14.405$

Note: The male and female weights must be calculated separately and the weights must be reported in pounds and tenths. If the weights are taken in pounds and ounces A.H.D. No. 33 may be used to convert the ounces to tenths of a pound.

* The coefficient of variation may be described as a mathematical expression of the variability in a sample. For example, if all weights are alike the coefficient of variation is zero, but as the variability increases the numerical value of the coefficient of variation increases.